Auto-Transformers

Auto-transformers definition: a single winding transformer with the primary and secondary windings magnetically and electrically connected.

So far, we have dealt with transformers that have no electrical connection between the primary and secondary winding. The only connection has been magnetic. Auto-transformers, on the other hand, do have an electrically conductive link between the primary and secondary windings.

There is only one winding in an auto-transformer. The common winding is the portion shared by the primary and secondary.

All the rules for dual- and multi-winding transformers apply to auto-transformers.

Step-Down Auto-Transformers

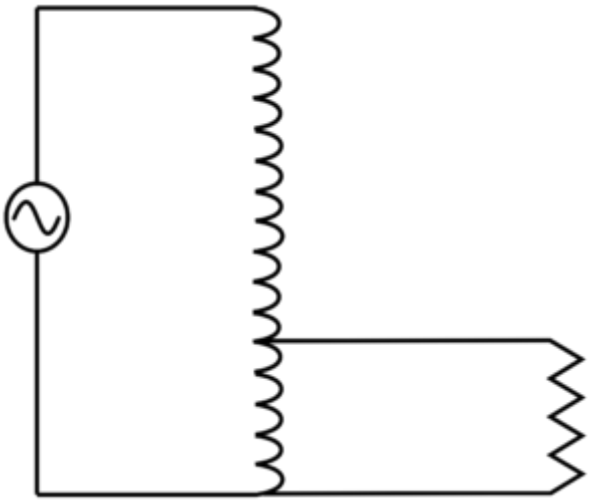

Figure 20. Step-down auto-transformer

You will notice that there is only one winding for the entire transformer. The portion of the winding before the load is referred to as the primary, and the portion of the winding that is in parallel to the load is referred to as the secondary or common winding.

Video Alert!

This video provides an explanation of how step-down transformers work. In it, you will be shown how to calculate for winding currents, voltages, and power.

Step-Up Auto-Transformers

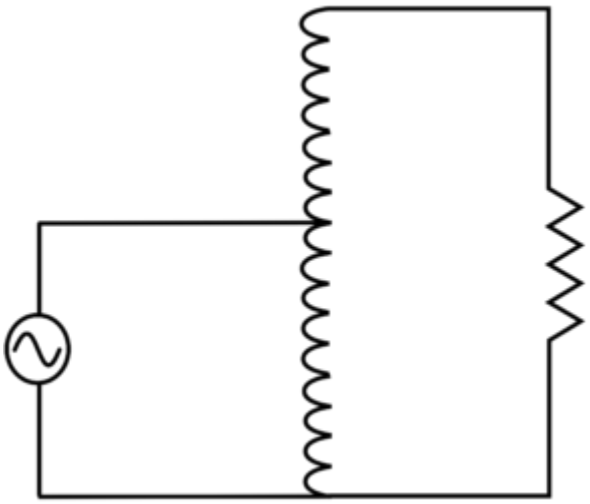

Figure 21. Step-up auto-transformer

A step-up auto-transformer works on the exact same principles as a step-down transformer. The only difference is that the voltage across the load will be larger than the source voltage. All the same rules apply as a step-down auto-transformer.

Video Alert!

This video provides an explanation of how step-up transformers work. In it, you will be shown how to calculate for winding currents, voltages, and power.

Steps for Solving Auto-Transformer Calculations

Follow these steps when doing auto-transformer calculations:

1. Assign polarities – load polarity is determined by which terminal is most positive with respect to the other terminal.
2. Calculate max high and low voltage winding ampacity.
3. Plot current flow through the load and the series load winding.
4. Calculate max load VA.
5. Calculate line amps based on load VA.
6. Plot current flow according to Kirchhoff's current law.

Buck/Boost Auto-Transformers

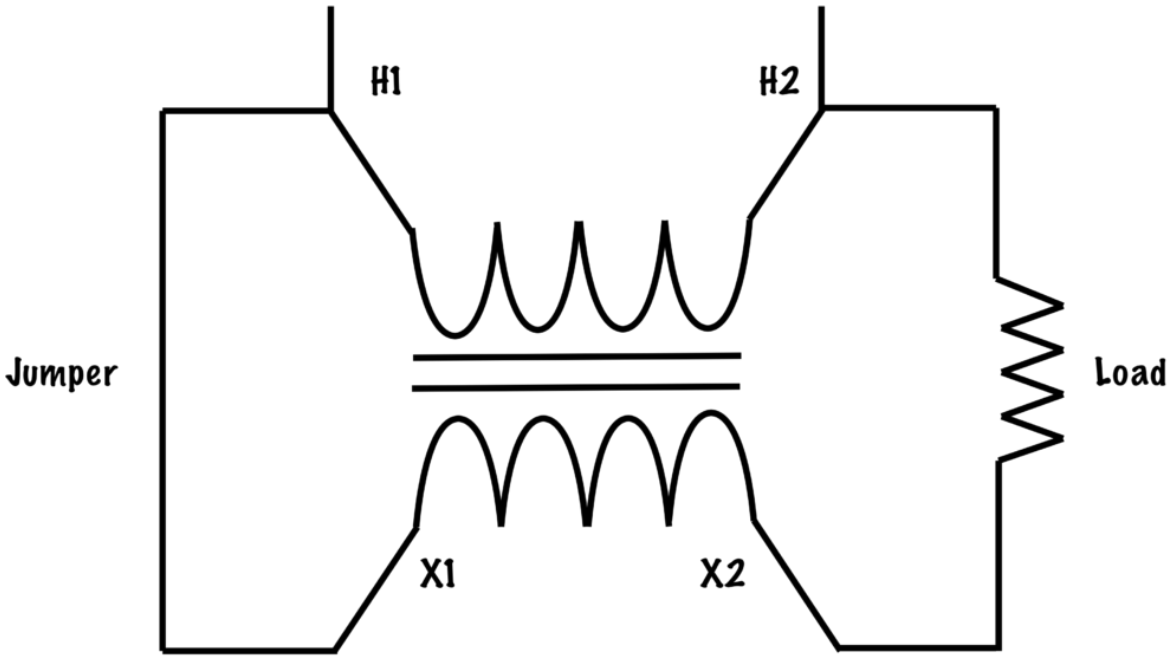

Figure 22. Standard two-winding transformer as auto-transformer

One of the defining principles of an auto-transformer is that it shares a common magnetic and electrical circuit. It is possible to connect a standard two-winding transformer as an auto-transformer. I know that this sounds like magic but it is very real. It is much like how we tested for the polarity of an additive or subtractive transformer.

How the polarities are connected will determine whether or not the transformer is a buck or boost. In a buck configuration, the two winding voltages will subtract from one another to provide the load voltage. In a boost configuration, the two winding voltages will add to one another to provide the load voltage.

Video Alert!

This video will walk through how a buck/boost auto-transformer operates and how to determine the calculations.

Attributions